

The whirl in the funnel cloud was plainly seen by a number of observers, and was counter-clockwise. It was not plainly evident in the distribution of the débris. A number of trees were twisted, some twisted off, and the twisting was mostly in a counter-clockwise direction. By far the larger number of trees felled, however, fell forward as though blown down by a straight wind. Some made different angles with the path of the storm, but no regularity could be detected, either in the center line of the path or on either side. The path was nowhere clear cut, many trees being left standing here and there even where the storm apparently had most force.

The length of path from A to I was about 14 miles; the path over which the funnel cloud was actually observed, D to I, was about 7 miles. The apparent speed of advance of the storm—reckoned from time observations at Seddon Island, Mango, and Seffner—was about 20 miles per hour and this agrees closely with the estimate of several observers. The width of the path was about a hundred yards at the point of greatest destruction.

The only person killed was the Rayborn child.

Tornadoes are uncommon in central Florida and the occurrence of this one is for that reason more noteworthy. None has been recorded in this vicinity since the opening of the Tampa office of the Weather Bureau in 1890; but according to newspaper accounts one of considerable intensity crossed the northern part of the city on March 17, 1887.

551.515 (772)

TORNADO OF MARCH 23, 1917, AT NEW ALBANY, IND.

By FERDINAND J. WALZ, Professor of Meteorology.

[Weather Bureau Office, Louisville, Ky., Apr. 7, 1917.]

New Albany, Ind., is situated on the north shore of the Ohio River, opposite the west end of Louisville, Ky. Its population is about 26,000. A short distance back of the city proper there is a range of high hills popularly known as "The Knobs," but which in reality might be called bluffs of the Ohio River. The city is built on the flood plain at the base of these "Knobs," which were previously supposed to offer complete protection from tornadic and similar destructive storms. The tornado of March 23, 1917, however, came from beyond these "Knobs," passing over a portion known as "Silver Hills," whence it descended into the valley or basin lying between these hills and the Ohio River. It showed strength and great destruction occurred from the base of Silver Hills eastward.

The storm moved along a nearly straight path in an east-northeast direction, cutting a wide swath through the entire north side of the city. The width of the path of practically total destruction varied between 1,000 and 1,500 feet, with an area along each side varying between 600 and 1,000 feet in which there was a great deal of damage, mostly in spots. The length of the path of the storm, as shown by the destruction in New Albany and vicinity, was about 3½ miles. The storm continued on, however, in the same east-northeast direction and crossed the Ohio River into Kentucky about 10 miles above New Albany. It caused considerable damage at Harrods Creek, Ky., which lies in a direct east-northeast line from New Albany (see fig. 1 on p. 170).

Many articles of furniture and clothing, and other débris carried away by the storm, were found on farms and fields in Kentucky 25 to 40 miles from New Albany, whence they came. A family picture, which was in a house occupied in part by the James Franconia Grocery,

Vincennes Street and Charlestown Road, New Albany, was found at Skylight, Ky., having been carried a distance of 25 miles. Also a jar of sweet pickles from the same grocery was found in a ditch on the same farm, the jar being uninjured. In the same vicinity were found articles of clothing, shingles, roofing material, flooring, weatherboarding, a kitchen safe door, letters, and papers.

In New Albany 45 persons, men, women, and children, were killed outright, or have died since from their injuries; several hundred others were injured, a number of whom will probably succumb to their injuries. Between two and three hundred houses were destroyed, including several manufacturing plants, one large greenhouse, two schoolhouses, and one fire-engine house and tower, while several hundred more houses were damaged. Practically 2,500 people, including between 350 and 400 families, were made homeless.

The district which suffered most severely consisted of cottages occupied and mostly owned by working people, and with their cottages went not only their homes but their household goods, clothing, and in fact, their all. The most costly residence caught in the destructive path of the storm was the De Pauw homestead, an old and substantial structure built of brick on a stone foundation, two stories and an attic in height. This structure was largely demolished, one inmate killed and several others injured. Mr. VanVreedenburg, one of the occupants of this residence, states that he and his mother were in a room on the second floor when they heard the approach of the storm, the sound of which he describes as resembling a sawmill buzzing in a low key. Almost immediately the storm struck the house and the next thing he realized was that he and his mother were in the midst of a mass of débris. The windows of the house were all gone, and a partition wall pushed in. Both suffered injury, but neither was seriously hurt. The room in which they were was located on the windward side of the building, and the instant the storm struck, the windows were all blown away. The stairway leading to the first floor was torn down. Many large and beautiful old shade trees and other trees at the De Pauw homestead were destroyed, a number being uprooted and others snapped off at the trunk.

The storm began at 3:08 p. m. and lasted only about five minutes. New Albany, Ind., and surroundings are plainly visible from the windows of the Weather Bureau office in Louisville, Ky., the scene of the storm being about 4½ miles in a northwest line from the office. The approach of the storm was viewed from the office windows, but the scene was soon cut off by heavy sheets of rain. The storm from this distance had the appearance only of an ordinary thunderstorm, with a dark-green background and attended by dark-green clouds. The storm was also attended by heavy downpours of rain, but there were comparatively little thunder and lightning. No tornado or funnel-shaped cloud was observed; but this could readily have been hidden by the blanket of rain which soon blotted out the view. There is plenty of evidence, however, both in the enormous force exerted by the storm, and in the deposit of the débris in its path, that the storm was tornadic. Also the manner in which some houses not entirely destroyed were twisted off their foundations, together with the twisting of trees, shows tornadic force. The center line of the destructive forces of the storm was plainly traced; also destruction seems to have been wrought more from a south direction than from a north; that is, it appears in many instances that the wind force from the south side was greater than from the north side,

although this was not universally the case, as, for example, one house was moved bodily from its foundation 3 to 6 feet in a southeasterly direction.

The storm obviously developed in connection with the passage eastward of a long trough of low pressure in which there was a well-defined windshift line. The 8 a. m. (75th meridian time) weather map of March 23 showed an area of low pressure centered near Lake Michigan, and which extended in a trough from this center southward practically to eastern Texas. The windshift line of this trough at that time would extend

clouds apparently moving from the west. These cloud formations and movements clearly evidenced strong transverse and counter currents in the air as early as 7 a. m. Strong south winds, velocity ranging between 30 and 35 miles per hour, prevailed at Louisville from the early morning until 3:08 p. m., when they shifted suddenly to west and attained a velocity of 52 miles per hour from that direction for a period of 5 minutes, from 3:08 to 3:13 p. m., the extreme velocity for 1 mile being at the rate of 60 miles per hour. Excessive rain, 0.73 inch, fell from 3:08 p. m. to 3:41 p. m., during which time

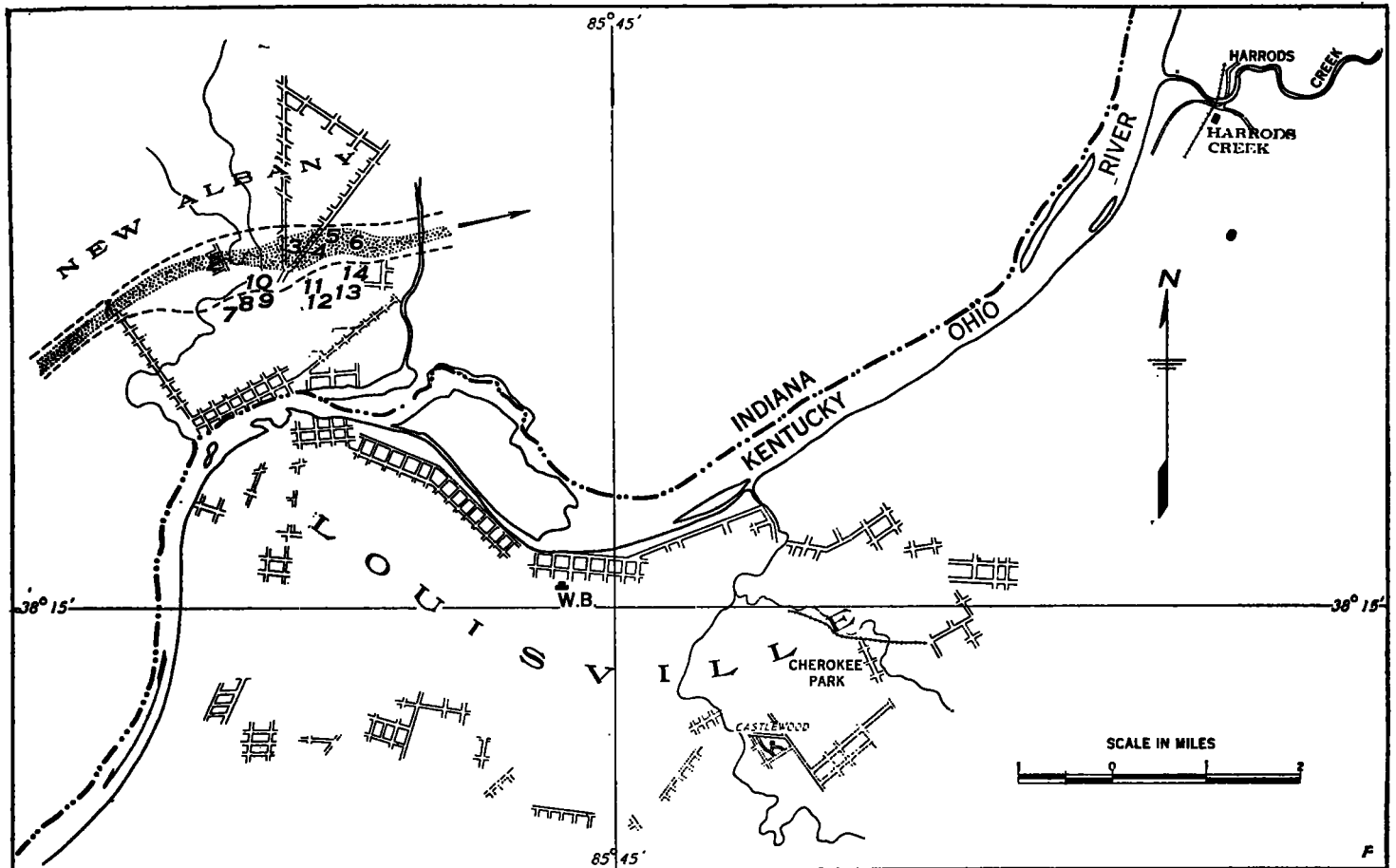


FIG. 1.—Map of the vicinity of New Albany, Ind., showing path of the tornado of March 23, 1917. (Compiled by Weather Bureau from U. S. Geological Survey map of Jefferson County, Ky., and a plat of New Albany, Ind.)

Path of total destruction is stippled; lateral zones of great damage are delimited by dash lines; numbers mark isolated localities of extensive damage and refer as follows:

- | | | | |
|-----------------------------|----------------------------------|--|---------------------------|
| 1. Silver Hills. | 5. Miss de Pauw's residence. | 9. Cemetery. | 12. Hosiery mills. |
| 2. Olden Street School. | 6. Cemetery. | 10. Jacobson's Kitchen Furniture Manufacturing Co. | 13. Shelby Street School. |
| 3. Kahler Wood Specialties. | 7. International Harvester Co. | 11. Woolen mills. | 14. Soldiers' Cemetery. |
| 4. Public School. | 8. J. F. Tegar Public Warehouse. | | |

W. B. Weather Bureau office in Louisville, Ky.

→ Direction of movement.

from Green Bay, Wis., southwestward through St. Louis to near Houston, Tex. With the eastward movement of the general storm, the 8 p. m. map (75th meridian time) shows this windshift line then would extend from about Sault Ste. Marie, Mich., through Cleveland, Ohio, and on through Kentucky east of Lexington to near Atlanta, Ga. Thus the line evidently must have passed over Louisville about 3 p. m.

Low scuds of clouds were observed at Louisville in the early morning, driving rapidly from the southwest. Other clouds above this layer were driving rapidly from the southeast; while still above this layer were other

there were two very heavy dashes, (1) 0.32 inch from 3:08 to 3:20 p. m., and (2) 0.20 inch from 3:36 to 3:41 p. m. The barometer fell steadily about 0.30 inch between midnight and 10 a. m., and rapidly, 0.45 inch, from 10 a. m. to 3 p. m. The sudden drop at the time of the tornado was 0.10 inch, followed by an immediate rise of 0.20 inch, the temperature falling at the same time from 69° to 58°. No damage was done at Louisville, although quite a thundersquall was experienced.

I am submitting herewith a copy of the barograph trace made at the Louisville, Ky., station, located 4½ miles southeast of the tornado path; also a copy of the

barograph trace made at my residence at Castelwood, Ky., located about 3 miles southeast of the Louisville station, that is, about $7\frac{1}{2}$ miles southeast of the tornado belt (see fig. 1 and 2).

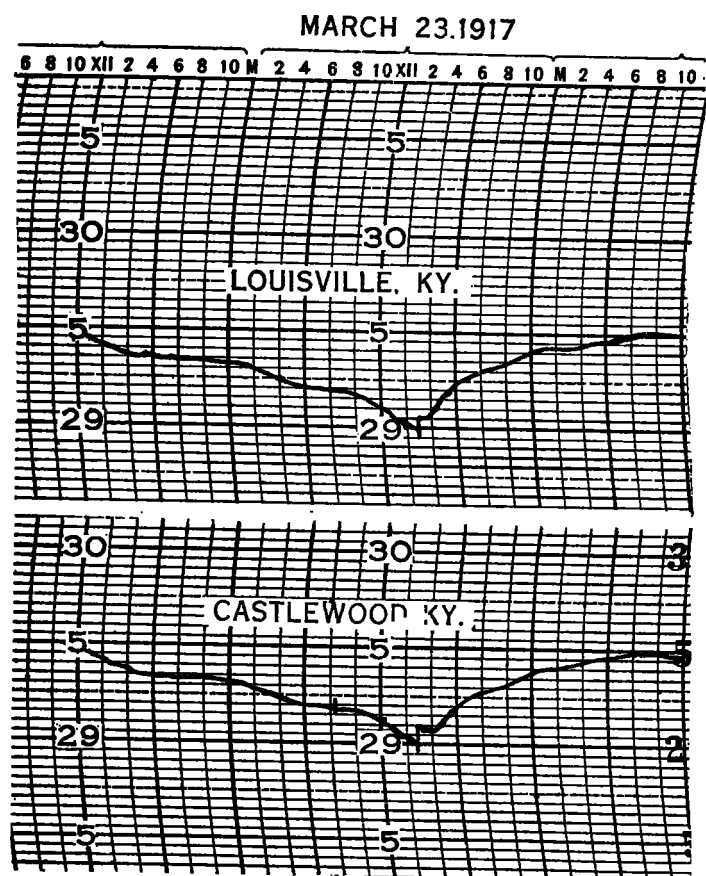


Fig. 2.—Barograms recorded by Richard barographs at the Louisville office and at Castlewood, Ky., accompanying the New Albany tornado (station pressures; 90th meridian time), showing effect of pressure changes.

Among the great mass of destruction, the following seems to call for special mention: The Olden Street School for colored children, in which 40 teachers and children were gathered, was entirely destroyed, all the inmates injured, 12 being killed.

Kahler's Wood Specialties Manufacturing plant was completely destroyed, 8 men were killed and of the other occupants all but two were seriously injured.

One entire family, consisting of five persons, perished; the father Edward Johns being decapitated and horribly mangled.

A painter, Clarence Moss, while working on a house was killed by flying timbers, his head being severed from his body.

Of another family of six, all but the father, who was away at the time, perished. The mother and two children were killed in the house when it was demolished, while two small children who were in the front yard when the storm struck were caught up and carried away, their bodies being found two squares from the ruins of their home. The body of another young girl was found about a quarter of a mile from her home where she was known to have been when the storm struck. Her home was absolutely wiped out, not a piece being left standing. Charles Newkirk had a fence paling driven through his body, but lived for a few days. Mrs. Alice Hartley had her eyes put out by flying glass. The money damage is estimated between one and one and a half million dollars.

FISH KILLED BY THE COLD WAVE OF FEBRUARY 2-4, 1917, IN FLORIDA.

By RUY H. FINCH, Assistant.

[Dated: Seismological Investigations, Weather Bureau, Apr. 20, 1917.]

An interesting occasional and but little known effect of cold waves over shallow waters of the Tropics and sub-Tropics is the killing of thousands of fish. Many species are so chilled as to be rendered helpless and are either killed directly by drowning or are washed ashore in a comatose state. This phenomenon is locally known as "freezing" of fish, though the temperature of the water may be several degrees above its freezing point.

This killing of fish by chilling is not confined entirely to tropical and subtropical waters, for great quantities are sometimes killed along the Atlantic coast as far north as New England during very severe cold waves, and it is an occasional fall and winter accompaniment of the Texas norther.¹ Somewhat similar effects have been reported from South Africa.² There, however, the cooling of the water seems to be due to variations in position of cold ocean currents rather than to cold air temperatures.

This "freezing" phenomenon was observed in Florida during the cold wave of February 2-4, 1917, along most of the coast line, both Atlantic and Gulf, though in the northernmost regions affected mortality was confined chiefly to shell fish and the smaller free swimming varieties.

The cooling of the water is directly due to contact with cold air,³ hence the great expanses of shallow water surrounding the Florida Keys and in the numerous shallow bays, but little affected by tides, are excellent exposures for rapid cooling. The temperature fell decidedly during the night of February 2-3, and air temperatures at freezing were reached over most of the State except the Florida Keys, an air minimum of 43.5° being reached at Key West.

The greatest "freeze" of fish on record in Florida is that of January 12, 1886, when the lowest temperature ever observed in Key West, 41°, was reached. The countless thousands of fish washed up during this "freeze" were used as fertilizer at many places. Residents near the shore went fishing by strolling along the beach with a basket under the arm and picked up selected varieties of "frozen" fish as fast as they were washed ashore.

As a rule, gregarious species were not affected as much as those of solitary habits, for the former have the tendency to leave the cold coastal waters and go out to sea. Along the east coast many varieties availed themselves of the proximity of the Gulf Stream and went out to it, where they remained until the return of normal temperatures.

In the neighborhood of Cedar Keys, as far north as marked mortality occurred, the majority of the species observed to have been killed were small fish, 2 to 3 inches in length, crabs, small shrimp, sand worms, etc. In the vicinity of Tampa some mullet, grunts, and jackfish were killed. Farther south more and larger varieties were affected. In the neighborhood of Key West large barracuda and even sharks were thrown out upon the beaches; conchs and shellfish succumbed by the thousand; and one octopus of moderate size was noticed apparently dead. A great many fish were numbed by the cold, and, if they were not washed ashore, came out all right as soon as the

¹ Report of U. S. Fish Commission, 1886, pp. 68-72.

² Union of South Africa, Province of the Cape of Good Hope. Marine Biological Report No. 2, 1914, pp. 18-34.

³ The chilling of the water must also be due, in part at least, to conduction to the chilled ground but chiefly to direct radiation into the cold, dry, transparent air brought down to these warm latitudes by the unusual weather conditions.—C. A., Jr.